AMENDMENTS TO THE CLAIMS

Claim 39. (New) A method for filling a metal into fine recesses in a surface of a substrate, comprising:

providing a substrate having fine recesses covered with a seed layer in a surface of the substrate;

reinforcing the seed layer by contacting the surface of the seed layer in a first plating liquid having ions of a metal and a complexing agent, and then rotating the substrate to drain away the first plating liquid by the action of centrifugal force;

filling said fine recesses with the metal by electroplating a surface of the reinforced seed layer with contacting the substrate in a second plating liquid, and then rotating the substrate to drain away the second plating liquid by the action of centrifugal force;

washing a surface of the metal on the substate with water or washing liquid comprising water; and

removing the metal on an edge portion of the substrate by supplying an etching liquid to a surface of the metal on the edge portion of the substrate;

wherein the washing the surface of the metal is performed prior to the removing the metal on the edge portion of the substrate.

Claim 40. (New) The method according to claim 39, wherein said first plating liquid has a higher polarization than said second plating liquid.

Claim 41. (New) The method according to claim 39, wherein the reinforcing the seed layer is performed by electroplating a surface of the seed layer.

Claim 42. (New) The method according to claim 41, wherein the reinforcing in the first plating liquid is performed at a first current density and the electroplating in the second plating liquid is performed at a second current density.

Claim 43. (New) The method according to claim 41, wherein the second current density is higher than the first current density.

Claim 44. (New) The method according to claim 39, further comprising measuring a film thickness of the metal on the substrate after the electroplating in the second plating liquid.

Claim 45. (New) The method according to claim 39, further comprising annealing the substrate after removing the metal on the edge portion of the substrate.

Claim 46. (New) The method according to claim 38, further comprising polishing the surface of the metal on the substrate to remove at least a portion of the metal except an interior of the recesses.

Claim 47. (New) The method according to claim 46, further comprising forming a protective film on an exposed surface of the metal after the polishing.

Claim 48. (New) The method according to claim 39, wherein a pH of the first plating liquid is in a range of 7-14.

Claim 49 .(New) The method according to claim 39, wherein a concentration of the complexing agent is in range of 0.1-500 g/l.

Claim 50. (New) The method according to claim 39, wherein the complexing agent is selected from the group consisting of ethylenediamine tetracetic acid, ethylenediamine, N,N'N",N'-ethylene-di-nitro-tetrapropane-2-ol, pyrophosphoric acid, iminodiacetic acid, diethylenetriamine pentacetic acid, diethylenetriamine, triethylenetetramine, tetraethylenepentamine, diaminobutane, hydroxyethyl ethylenediamine, ethylendiamine tetrapropionic acid,

ethylenediamine tetramethylene phosphonic acid, diethylenetriamine tetramethylene phosphonic acid, and diethylenetriamine pentamethylene phosphonic acid.

Claim 51. (New) The method according to claim 39, wherein the first plating liquid further comprising at least one additive selected from the group consisting of organic acids, amines, glycerin, gelatin, heavy metal ions, thiazoles, triazoles, thiadiazoles, imidazoles, pyrimidines, sulfonic acids, and glutamic acids.

Claim 52. (New) The method according to claim 42, wherein the first current is a direct current and a current density of the first current is in a range of 0.01 A/dm^2 -30 A/dm^2.

Claim 53. (New) The method according to claim 52, wherein the current density of the first current is in a range of 0.1 A/dm^2-3 A/dm^2.

Claim 54. (New) The method according to claim 42, wherein the first current is a pulse current and a current density of the first current is in a range of 0.1 A/dm^2-200 A/dm^2.

Claim 55. (New) The method according to claim 39, wherein a temperature of the first plating liquid is in a range of 10°C-80°C.

Claim 56. (New) The method according to claim 39, wherein the second plating liquid comprising an additive for enhancing a leveling property.

Claim 57. (New) The method according to claim 39, further comprising measuring a film thickness of the seed layer on the substrate prior to the electroplating in the first plating liquid.

Claim 58. (New) The method according to claim 39, wherein an oxidizing agent solution and a silicon oxide film etching agent are supplied simultaneously or alternately to a backside of the substrate while removing the metal layer on the edge portion of the substrate.

Claim 59 .(New) The method according to claim 58, wherein the oxidizing agent solution is the same as an oxidizing agent solution contained in the etching liquid.

Claim 60. (New) The method according to claim 58, wherein the supply of the oxidizing agent is stopped first to obtain a hydrophobic surface, or the supply of the silicon oxide film etching agent is stopped first to obtain a water-saturated surface.

Claim 61. (New) The method according to claim 39, wherein pure water is supplied to replace the etching liquid with pure water and remove the etching liquid after removing the metal layer on the edge portion of the substrate.

Claim 62. (New) The method according to claim 61, wherein the substrate is dried by spin-drying after the supply of the pure water.

Claim 63. (New) A method for filling a metal into fine recesses in a surface of a substrate, comprising:

providing a substrate having fine recesses covered with a seed layer in a surface of the substrate;

electroplating a surface of the seed layer by contacting the surface of the seed layer in a plating liquid having ions of a metal to form a metal layer on the seed layer, and then rotating the substrate to drain away the plating liquid by the action of centrifugal force;

washing a surface of the metal layer on the substrate with water or washing liquid comprising water, and

removing the metal layer on an edge portion of the substrate by supplying an etching liquid to a surface of the metal layer on the edge portion of the substrate;

wherein the washing of the surface of the metal layer is performed prior to the removing the metal on the edge portion of the substrate.

Claim 64. (New) The method according to claim 63, wherein the electroplating the substrate of the seed layer comprises a first-stage plating and a second-stage plating, wherein the first-stage

plating is performed at a first current density, and then the second-stage plating is performed at a second current density.

Claim 65. (New) The method according to claim 64, wherein the second current density is higher than the first current density.

Claim 66. (New) The method according to claim 63, further comprising measuring a film thickness of the metal layer on the substrate after the electroplating.

Claim 67. (New) The method according to claim 63, further comprising annealing the substrate after removing the metal layer on the edge portion of the substrate.

Claim 68. (New) The method according to claim 63, further comprising polishing the surface of the metal layer on the substrate to remove at least a portion of the metal except an interior of the recesses.

Claim 69. (New) The method according to claim 68, further comprising forming a protective film on an exposed surface of the metal after the polishing.

Claim 70. (New) The method according to claim 64, wherein the first current is a direct current and a current density of the first current is in a range of 0.01 A/dm^2-30A/dm^2.

Claim 71. (New) The method according to claim 70, wherein the current density of the first current is in a range of 0.1 A/dm^2-3 A/dm^2.

Claim 72. (New) The method according to claim 64, wherein the first current is a pulse current and a current density of the first current is in a range of 0.01 A/dm^2-200 A/dm^2.

Claim 73. (New) The method according to claim 63, further comprising measuring a film thickness of the seed layer on the substrate prior to the electroplating in the plating liquid.

Claim 74. (New) The method according to claim 63, wherein the electroplating the surface of the seed layer by contacting the surface of the seed layer in the plating liquid is performed when the substrate is rotating.

Claim 75. (New) The method according to claim 63, wherein an oxidizing agent solution and a silicon oxide film etching agent are supplied simultaneously or alternately to a backside of the substrate while removing the metal layer on the edge portion of the substrate.

Claim 76. (New) The method according to claim 75, wherein the oxidizing agent solution is the same as an oxidizing agent solution contained in the etching liquid.

Claim 77. (New) The method according to claim 75, wherein the supply of the oxidizing agent is stopped first to obtain a hydrophobic surface, or the supply of the silicon oxide film etching agent is stopped first to obtain a water-saturated surface.

Claim 78. (New) The method according to claim 63, wherein pure water is supplied to replace the etching liquid with pure water and remove the etching liquid after the removing the metal layer on the edge portion of the substrate.

Claim 79. (New) The method according to claim 78, wherein the substrate is dried by spin-drying after the supply of the pure water.